

CLAIMS

[1] A radio transmission control method for a MIMO system, the MIMO system comprising a radio transmitter apparatus having a plurality of antennas and a radio receiver apparatus having a plurality of antennas for transmitting a plurality of signals to each other through SDM, the method comprising the steps of:

 sending a pilot signal by the radio transmitter apparatus;
 receiving the pilot signal and estimating
transmission-related information corresponding to the pilot signal
by the radio receiver apparatus;

 selecting a transmission signal to be used in the radio
transmitter apparatus based on the estimated transmission-related
information;

 notifying the radio transmitter apparatus of a control signal
describing the transmission signal to be used; and

 selecting an antenna to be used based on the control signal
and sending the information signal from the selected antenna to
the radio receiver apparatus, by the radio transmitter apparatus.

[2] A radio transmission control method according to claim 1, wherein
the transmission-related information estimated by the radio receiver
apparatus is a propagation vector representing a correlation between
the received pilot signal and a known pilot signal.

[3] A radio transmission control method according to claim 2, wherein the transmission signal to be used selected by the radio receiver apparatus is a predetermined number of transmission signals selected in a decreasing order of a norm of the propagation vector.

[4] A radio transmission control method according to claim 2, wherein the transmission signal to be used selected by the radio receiver apparatus is a predetermined number of transmission signals selected from among a plurality of transmission signals so that a spatial correlation to one another based on the propagation vector becomes small.

[5] A radio transmission control method according to claim 2, wherein the step of selecting the transmission signal to be used comprises the steps of:

- selecting all combinations of the plurality of transmission signals;

- predicting an output SINR based on the propagation vector obtained by the radio receiver apparatus in a case where a predetermined combination of the transmission signals is sent;

- determining an evaluation value with respect to the predetermined combination of the transmission signals, based on the predicted output SINR; and

- selecting a combination of the transmission signals having

a largest evaluation value among the evaluation values with respect to all the combinations of the transmission signals.

[6] A radio transmission control method according to claim 2, wherein the step of selecting the transmission signal to be used comprises the steps of:

- selecting all combinations of a plurality of transmission signals;

- predicting an output SINR based on the propagation vector obtained by the radio receiver apparatus in a case where a predetermined combination of the transmission signals is sent;

- determining an evaluation value with respect to the predetermined combination of the transmission signals, based on the predicted output SINR; and

- selecting a combination of the transmission signals having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission signals and selecting a transmission format number determined based on an output SINR of each transmission signal of the selected combination, as the transmission signal to be used, by consulting a table describing a correspondence relationship among a transmission format number, an output SINR, a transmission format, and a transmission speed.

[7] A radio transmission control method according to claim 1, wherein,

by applying a multi-carrier transmission system to SDM transmission between the radio transmitter apparatus and the radio receiver apparatus, each of the signal processing is performed individually for each carrier.

[8] A radio transmission control method according to claim 2, for a radio power transmission apparatus, the radio power transmission apparatus performing each of the following signal processing with respect to all sub-carriers by applying a multi-carrier transmission system to SDM transmission between the radio transmitter apparatus and the radio receiver apparatus, wherein the step of selecting the transmission signal to be used comprises the steps of:

- selecting all combinations of a plurality of transmission signals;

- predicting an average output SINR based on the propagation vector obtained by the radio receiver apparatus in a case where a predetermined combination of the transmission signals is sent;

- determining an evaluation value with respect to the predetermined combination of the transmission signals, based on the predicted average output SINR: and

- selecting a combination of the transmission signals having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission signals.

[9] A radio transmission control method according to claim 1, wherein the step of sending the pilot signal comprises sending the pilot signal from each transmission beam;

the step of selecting the transmission signal to be used comprises selecting a transmission beam to be used;

the step of notifying comprises notifying the radio transmitter apparatus of the transmission beam to be used with a control signal; and

the step of sending the information signal comprises selecting a transmission beam to be used based on the notified control signal, and sending an information signal from the selected transmission beam to the radio receiver apparatus.

[10] A radio transmission control method according to claim 1, wherein, as the pilot signal sent from the radio transmitter apparatus, a series of pilot signals previously determined between the radio transmitter apparatus and the radio receiver apparatus is used.

[11] A radio transmission control method according to claim 2, wherein the step of selecting the transmission signal to be used comprises the steps of:

selecting all combinations of transmission power of a plurality of transmission signals;

predicting an output SINR based on the propagation vector

obtained by the radio receiver apparatus in a case where a predetermined combination of transmission power is sent;

determining an evaluation value with respect to a predetermined combination of the transmission signals, based on the predicted output SINR; and

selecting a combination of the transmission power having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission power of the transmission signals and selecting a transmission format number and transmission power determined based on an output SINR of the transmission signal of each transmission power of the selected combination, as the transmission signal to be used, by consulting a table describing a correspondence relationship among a transmission format number, an output SINR, a transmission format, and a transmission speed.

[12] A radio transmission control method according to claim 1, wherein SDM transmission between the radio transmitter apparatus and the radio receiver apparatus is combined with a CDMA system.

[13] A radio receiver apparatus for transmitting a signal with respect to a radio transmitter apparatus through SDM, comprising:

a plurality of antennas for receiving a pilot signal sent from the radio transmitter apparatus;

a pilot signal detecting part for estimating

transmission-related information corresponding to the pilot signal received at the plurality of antennas;

a transmission signal determining part for selecting a transmission signal to be used in the radio transmitter apparatus, based on the transmission-related information estimated by the pilot signal detecting part; and

a control information transmitting part for notifying the radio transmitter apparatus of a control signal describing the transmission signals to be used selected by the transmission signal determining part.

[14] A radio receiver apparatus according to claim 13, wherein the pilot signal detecting part estimates a propagation vector representing a correlation between the received pilot signal and a known pilot signal as the transmission-related information.

[15] A radio receiver apparatus according to claim 14, wherein the transmission signal determining part selects, as the transmission signal to be used, a predetermined number of transmission signals in a decreasing order of a norm of the propagation vector.

[16] A radio receiver apparatus according to claim 14, wherein the transmission signal determining part selects, as the transmission signal to be used, a predetermined number of transmission signals

from among a plurality of transmission signals such that a spatial correlation to one another based on the propagation vector becomes small.

[17] A radio receiver apparatus according to claim 14, wherein the transmission signal determining part comprises:

- a signal candidate selecting part for selecting all combinations of a plurality of transmission signals;

- an output SINR calculating part for predicting an output SINR based on the propagation vector obtained in a case where a predetermined combination of the transmission signals is sent;

- a transmission evaluating part for determining an evaluation value with respect to the predetermined combination of the transmission signals, based on the predicted output SINR; and

- a use signal determining part for selecting a combination of the transmission signals having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission signals.

[18] A radio receiver apparatus according to claim 14, wherein the transmission signal determining part comprises:

- a signal candidate selecting part selecting all combinations of a plurality of transmission signals;

- an output SINR calculating part predicting an output SINR based

on the propagation vector obtained in a case where a predetermined combination of the transmission signals is sent;

a transmission evaluating part for determining an evaluation value with respect to the predetermined combination of the transmission signals, based on the predicted output SINR; and

a use signal determining part selecting a combination of the transmission signals having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission signals and selecting a transmission format number determined based on an output SINR of each transmission signal of the selected combination, as the transmission signal to be used, by consulting a table describing a correspondence relationship among a transmission format number, an output SINR, a transmission format, and a transmission speed.

[19] A radio receiver apparatus according to claim 14, wherein the transmission signal determining part comprises:

a signal candidate selecting part selecting all combinations of transmission power of a plurality of transmission signals;

an output SINR calculating part predicting an output SINR based on the propagation vector in the radio receiver apparatus obtained in a case where a predetermined combination of transmission power is sent;

a transmission evaluating part determining an evaluation value

with respect to a predetermined combination of the transmission signals, based on the predicted output SINR; and

a use signal determining part selecting a combination of the transmission power having a largest evaluation value among the evaluation values with respect to all the combinations of the transmission power of the transmission signals and selecting a transmission format number and transmission power determined based on an output SINR of the transmission signal of each transmission power of the selected combination, as the transmission signal to be used, by consulting a table describing a correspondence relationship among a transmission format number, an output SINR, a transmission format, and a transmission speed.

[20] A radio transmitter apparatus for transmitting a signal with respect to a radio receiver apparatus through SDM, comprising:

a signal sending part for sending pilot signals from a plurality of antennas to the radio receiver apparatus;

a control information receiving part for receiving, from the radio receiver apparatus, a control signal describing a transmission signal to be used selected by the radio receiver apparatus based on the transmission-related information corresponding to the pilot signal; and

a transmission signal determining part for selecting an antenna to be used, based on the control signal received by the control

information receiving part,

wherein the signal sending part sends an information signal from the antenna selected by the transmission signal determining part to the radio receiver apparatus.